

Optimizing potassium ferrate for textile wastewater treatment by RSM

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Abstract

Background: Application of potassium ferrate is a chemical oxidation approach used for water and wastewater treatment. The aim of this study is to apply central composite design (CCD) and response surface methodology (RSM) to optimize potassium ferrate consumption in the treatment of wastewater from carpet industries.

Methods: Samples in this experimental study were collected from wastewater, originating from a carpet factory. Wastewater sampling was carried out monthly for a period of two seasons. Ferrate oxidation experiments were conducted by means of a conventional jar-test apparatus. The time and speed for mixing were set with an automatic controller. Parameters of study were measured based on given methodologies in Standard method for examining water and wastewater. CCD and RSM were applied to optimize the operating variables including potassium ferrate dosage and pH.

Results: Results showed that potassium ferrate concentration (A), pH (B), their interactions (AB) and quadratic effects (A² and B²) were significant in the removal of COD, turbidity, color and TSS from carpet industries effluents. At an optimum point (COD: 160 mg/L of potassium ferrate and pH 4, turbidity: 165 mg/L of potassium ferrate and pH 4, color and TSS: pH 4.5 and 150 mg/L of potassium ferrate) removal efficiencies for COD, turbidity, color and TSS were 86, 86, 87 and 89%, respectively.

Conclusion: Potassium ferrate has a significant impact on pollutants decomposition and the removal of color from wastewater produced in carpet industries. This process can be employed for the pretreatment or post treatment of wastewaters containing refractory organic pollutants. CCD and RSM are suitable tools for experimental design.

Keywords: Advanced treatment, carpet wastewater, Statistical experiment design, Response Surface Methodology.

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